



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/511,212	10/13/2004	Steven T Peake	GB 020048	2126

24737 7590 07/21/2006

PHILIPS INTELLECTUAL PROPERTY & STANDARDS
P.O. BOX 3001
BRIARCLIFF MANOR, NY 10510

EXAMINER

LEE, EUGENE

ART UNIT	PAPER NUMBER
----------	--------------

2815

DATE MAILED: 07/21/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.		Applicant(s)	
	10/511,212		PEAKE, STEVEN T	
	Examiner		Art Unit	
	Eugene Lee		2815	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 09 May 2006.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-15 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-15 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 5/9/06 has been entered.

Drawings

2. The drawings are objected to under 37 CFR 1.83(a). The drawings must show every feature of the invention specified in the claims. Therefore, the distance between two immediately adjacent ruggedness regions is greater than a distance between two immediately adjacent source regions (claim 15) must be shown or the feature(s) canceled from the claim(s). No new matter should be entered.

From the drawings (see, for example, FIG. 1), the distance between two ruggedness regions 15 appear equal to a distance between source regions 13.

Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must

Art Unit: 2815

be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Claim Rejections - 35 USC § 112

3. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

4. Claim 15 is rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

The specification does not describe a distance between two immediately adjacent ruggedness regions is greater than a distance between two immediately adjacent source regions. Appropriate clarification and/or correction are required.

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

6. Claims 1 thru 9, and 11 thru 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Darwish et al. 5,688,725 in view of Kocon et al. 6,351,009 B1. Darwish discloses (see, for example, FIG. 11G) a vertical trench MOSFET (vertical power transistor trench-gate semiconductor device) comprising a semiconductor body, active area, plurality of electrically parallel transistor cells, gates (trench-gates) 102, N⁺ source regions (source regions) 112, N⁻ drift region (drain regions) 111, P body (channel-accommodating region) 116, and deep P⁺ region (ruggedness regions) 114. Darwish does not disclose source regions and the ruggedness regions ... as alternating stripe areas having a width perpendicular to and fully between each of two adjacent parallel stripe trench-gates. However, Kocon discloses (see, for example, FIG. 3C) trench gates 307 alternating in between P⁺ body regions 304, and N⁺ source regions 306. In column 5, lines 1-5, Kocon discloses that such an arrangement exploits the advantage of device size reduction. Therefore, it would have been obvious to one of ordinary skill in the art at the time of invention to have source regions and the ruggedness regions ... as alternating stripe areas having a width perpendicular to and fully between each of two adjacent parallel stripe trench-gates in order to exploit the advantage of device size reduction.

Regarding claim 2, Darwish in view of Kocon does not disclose the cell pitch being less than 2 μm , and wherein the length of the source region stripes being in the range 10 μm to 50 μm .

Art Unit: 2815

However, it was well within the skills of an artisan in the art to optimize the performance of a semiconductor device by adjusting the cell pitch and length of source region stripes in order to have an array of cells adequately operating in a reduced space. Therefore, it would have been obvious to one of ordinary skill in the art at the time of invention was made to have the cell pitch being less than 2 μm , and wherein the length of the source region stripes being in the range 10 μm to 50 μm because it was well within the skills of an artisan to optimize the performance of a semiconductor device by adjusting the cell pitch and length of source region stripes in order to have an array of cells adequately operating in a reduced space. See *In re Aller*, 105 USPQ 233.

Regarding claims 3-9, the limitations contained in claims 3-9 are functions of the cell pitch, and optimized in the same manner as the paragraph above.

Regarding claims 11, and 12, Darwish in view of Kocon does not disclose the doping concentration of the ruggedness regions being approximately 10 times greater than the doping concentration of the source regions, and the doping concentration of the ruggedness regions being about 10^{21} cm^{-3} and the doping concentration of the source regions being about 10^{20} cm^{-3} . However, it was well within the skills of an artisan in the art to optimize the performance of a semiconductor device by adjusting the doping concentrations of the ruggedness regions and the source regions in order to provide a semiconductor region that can adequately conduct a current from the source to the drain in a vertical trench MOSFET. Therefore, it would have been obvious to one of ordinary skill in the art at the time of invention was made to have the doping concentration of the ruggedness regions being approximately 10 times greater than the doping concentration of the source regions, and the doping concentration of the ruggedness regions being about 10^{21} cm^{-3} and the doping concentration of the source regions being about 10^{20} cm^{-3} .

Art Unit: 2815

because it was well within the skills of an artisan to optimize the performance of a semiconductor device by adjusting the doping concentrations of the ruggedness regions and the source regions in order to form a semiconductor regions that can adequately conduct a current from the source to the drain. See *In re Aller*, 105 USPQ 233.

Regarding claim 13, see, for example, FIG. 11G wherein Darwish discloses the deep P⁺ region extending further into the drift region 111 than the gates 102.

Regarding claim 14, see, for example, column 2, lines 32-36 wherein Darwish discloses the breakdown voltage being likely 60 volts or less (drain-source breakdown voltage of the device is in the range up to about 50 volts).

7. Claim 10 is rejected under 35 U.S.C. 103(a) as being unpatentable over Darwish et al. '725 in view of Kocon et al. '009 B1 as applied to claims 1-9, and 11-14 above, and further in view of Mo 6,316,806 B1. Darwish in view of Kocon does not disclose the semiconductor body being silicon. However, Mo discloses (see, for example, column 3, lines 40-44) a semiconductor device comprising a silicon wafer 44 wherein a trench is formed therein. It would have been obvious to one of ordinary skill in the art at the time of invention to have the semiconductor body being silicon in order to adequately form semiconductor regions in a semiconductor device such as a MOSFET.

Regarding the limitation "the ruggedness regions have ... doping concentration in the range of 10^{10}cm^{-3} to 10^{22}cm^{-3} , and wherein the source regions have ... a doping concentration in the range of 10^{18}cm^{-3} to 10^{21}cm^{-3} ". However, it was well within the skills of an artisan in the art to optimize the performance of a semiconductor device by adjusting the doping concentrations of

the ruggedness regions and the source regions in order to provide a semiconductor region that can adequately conduct a current from the source to the drain in a vertical trench MOSFET.

Therefore, it would have been obvious to one of ordinary skill in the art at the time of invention was made to have the ruggedness regions have ... doping concentration in the range of 10^{10}cm^{-3} to 10^{22}cm^{-3} , and wherein the source regions have ... a doping concentration in the range of 10^{18}cm^{-3} to 10^{21}cm^{-3} because it was well within the skills of an artisan to optimize the performance of a semiconductor device by adjusting the doping concentrations of the ruggedness regions and the source regions in order to form a semiconductor regions that can adequately conduct a current from the source to the drain. See *In re Aller*, 105 USPQ 233.

Response to Arguments

8. Applicant's arguments with respect to claims 1-15 have been considered but are moot in view of the new ground(s) of rejection.

INFORMATION ON HOW TO CONTACT THE USPTO

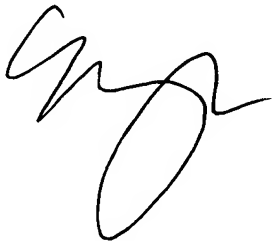
Any inquiry concerning this communication or earlier communications from the examiner should be directed to Eugene Lee whose telephone number is 571-272-1733. The examiner can normally be reached on M-F 8-5.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Kenneth Parker can be reached on 571-272-2298. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Art Unit: 2815

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Eugene Lee
July 12, 2006

A handwritten signature in black ink, appearing to be 'Eugene Lee', written in a cursive style.

**EUGENE LEE
PRIMARY EXAMINER**